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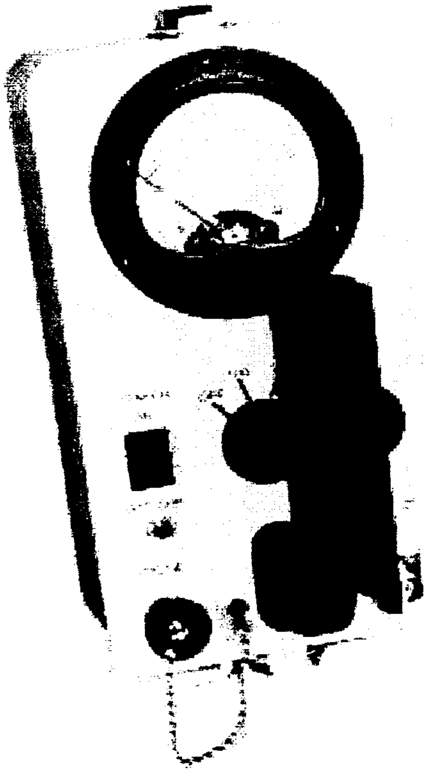
INSTRUCTION MANUAL



SURVEY METER

Model 3007A AND 3007A Sv

INSTRUCTION MANUAL

Model 3007A
Model 3007A Sv
Multi-Purpose
Survey Meter

Model 3700A
Model 3700A Sv
G.M.
Survey Meter

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1. GENERAL DESCRIPTION

1.1 INTRODUCTION

The Models 3700A and 3007A are portable, battery-powered, transistorized survey meters that can be used for radiation monitoring purposes and/or contamination measurements.

The Model 3700A has a permanently attached beta-gamma probe. It measures from 0 to 50 mR/h (milliroentgens per hour), 500µSv/h (micro Sieverts per hour) in three ranges and can be used for radiation surveys. The Model 3007A has a BNC connector on the panel to attach any one of a series of interchangeable probes. Both have an mR/h (µSv/h) scale and CPM (counts per minute), CPS (counts per second) scale.

The instruments have individual calibration controls for each range. Both instruments are equipped with a speaker which can be turned off. The speaker provides clicks that are in proportion to the radiation field intensity.

An adjustable carrying strap is supplied. A headphone for personal audible monitoring in high noise areas and a check source to verify operation are available as options.

1.2 THE PROBE

The Model 3700A uses a permanently attached Model 3073 Probe. It consists of a nickel plated brass housing with a beta window and detents which can lock the window open or closed.

The Model 3007A can use the different probes listed in Section 2.1.

1.3 THE PANEL ASSEMBLY

The panel assembly consists of 2 each 1.5 volt type D cell batteries, a 9V battery, a transistorized pulse shaping network, a detecting (metering) circuit, a regulated transistorized high voltage power supply, an audio output circuit and speaker.The system is shockproof and splashproof and is secured in its case with rapid takedown clamps in order to make access very simple.

1.4 THE CARRYING STRAP

The carrying strap provided is made of plastic and is adjustable from 30 to 60 inches in length.

1.5 THE HEADSET (OPTIONAL)

The Model 3020 Headset consists of a single piece magnetic headphone attached through a cable to a connector that mates to the jack mounted on the panel. A plastic dust cover is provided to cover the jack when the headphone is not in use.

1.6 CHECK SOURCE (OPTIONAL)

The Model 3001 Check Source is a generally licensed source of 5 µcuries of Cs-137. No specific NRC or state license is required by the user.

2. SPECIFICATIONS

2.1 RADIATION DETECTED:

Model 3700A with permanently attached Model 3073 Side Window Probe–beta, gamma

Model 3007A Optional Probes
360* Pancake Probe
370* End Window Probe–alpha, beta, gamma
3012 Side Window Probe–beta, gamma

*requires 3018, 3018-12, 3066-3, or 3067-3 Connector Cable

2.2 OPERATING CHARACTERISTICS

Ranges: 0-0.5,5,50mR/h, (0-5, 50, 500µSv/h) for Model 3700A and Model 3007A with the 3012 probe. 0-300, 3,000,30,000 CPM (0-5, 50, 500 CPS) for Model 3007A with thin window and pancake probes.

Environmental Effects
Temperature Range:................-10° C to 50° (14°F to 122°F)
Temperature Dependence: ....±15% throughout operating range
Relative Humdity Range: ....20 to 95% (non-condensing)
Accuracy: ....±20%
Reproducibility ....±10%
Calibration ....±20%
Energy Dependence:
Linearity: ....±20%
Exposure Rate Limit:..........1 R/h (10mSv/h)
Warm up time: ....none
Response time: ....5.4 sec. time constant

2.3 PHYSICAL CHARACTERISTICS

Readout
Visual: ....2.62" round meter
Audio: ....Panel Mounted Speaker (85dBA min)
Audio:..........................clicking type headset (optional)
Controls:...............4 position selector switch (i.e. OFF, X1, X10, X100); battery check switch
Power: ....2 "D" cells 1 "9V" battery
Connectors: ....microphone connection for Model 3020 headset
Panel Mounted Speaker ....(85dBA min.)
Mechanical
Case: ....ruggedized aluminum body & cover
Finish: ....polyurethane enamel

Dimensions	Millimeters	Inches
Width	111	4.38
Length	222	8.75
Height	108	4.25
	Grams	Pounds
Weight	1888	4.2

Accessories Included: ....carrying strap
Accessories, Optional: ....Model 3001 Source (5 µCi Cs-137)
Model 3020 Headset

3. THE THEORY OF OPERATION

3.1 INTRODUCTION

These instruments each have a halogen quenched Geiger tube, a regulated power supply, a transistorized pulse shaping and metering network, an indicating meter, an audio pulse amplifier, output speaker, and an optional headphone for audible monitoring of radioactivity.

3.2 THE GEIGER TUBE

1. Model 3700A—The 1-5114900 Geiger Mueller tube consists of a thin cylindrical shell which is the cathode, a fine wire anode suspended along the longitudinal axis of the shell, and an inert gas into which a small amount of halogen gas is inserted to act as a quenching agent. A voltage slightly less than that required to produce a discharge is applied between the anode and cathode. When a beta particle of sufficient energy impinges upon the tube, some of the particle's kinetic energy is used to ionize a gas molecule. The electrons, resulting from this ionization, are accelerated toward the anode by the electric field and in movement toward the anode cause additional ions to be formed. Similarly, gamma rays impinging upon the cathode wall cause secondary electrons to

be ejected, which in turn become the ionizing event. The creation of additional ions is very rapid, thus producing discharge in the gas. The small amount of halogen gas in the tube serves to help in quenching the discharge without self-consumption and restores the tube to its original condition. This discharge results in a pulse in the external circuit. The frequency of such pulses is proportional to the intensity of the radiation field.

2. Model 3007A—A selection of interchangeable probes is available. (See 2.1 for complete list and description.) With the Model 3012 Probe, the Model 3007A is equivalent to the Model 3700A. With the Model 360 or 370 Probes, the Model 3007A can be used for low-level contamination measurement.

3.3 SCALE RANGES

Three operating ranges (x100, x10, x1) are provided. These correspond respectively to 50, 5 and 0.5mR/h (500, 50 and 5µSv/h) equivalent radiation for the 3700A. Both units have mR/h (µSv/h) and CPM (CPS) scales.

3.4 THE AUDIO CIRCUIT

The audio circuit consists of Q304, U101, the speaker, and the accompanying circuitry. The circuit works by first receiving a pulse from the conditioning circuit. The pulse is then used to turn on the multivibrator, U101. The output of U101 turns on the speaker for the planned time, the product of C210 and R125. This is heard at the output as a click.

3.5 HEADPHONE

Personal audible monitoring is achieved by diode coupling to a headset. Each pulse counted by the pulse shaping circuit develops a positive pulse which is coupled to the headphone jack. When the 1000 ohm headset is connected at the jack, a pulse of approximately 12 volts is developed across the headset, resulting in a clear audible click.

4. OPERATION

WARNING: These instruments should be turned on before entering radiation areas to assure that they are functioning correctly. Units turned on in extremely high radiation areas (e.g., 50 times maximum meter reading) may give very low readings due to Geiger tube saturation.

4.1 INSTALLING THE BATTERIES

To put the instrument into operation:

1. Open the case by releasing the clamps at both ends, and remove the panel assembly.
2. Install the "D" cells & "9V" batteries in the battery holders, observing polarity as marked.
3. After installation of the batteries, slide them against the positive contact to insure good connection. Attach the retaining clip to the holder.
4. Replace panel assembly into case.

4.2 BATTERY CHECK

The "batt" check switch on the instrument panel is used to check the condition of the "D" batteries. This is done by depressing the "batt" switch while the range selector switch is in the "off" position and observing the meter deflection. The reading should be above 0.3 in the region marked "batt" on the meter scale. If the meter reading is low (or zero) first check for proper battery contact and polarity as in Step 2 of 4.1. Replace batteries if a low reading is still obtained. There is no check for the 9V battery. See 4.4.

4.3 "ON-OFF" AND RANGE SWITCH

The range switch control has an "OFF" position and three ranges labeled, "x100", "x10", and "x1". These are respectively 100 times, 10 times, and 1 times the scale reading in mR/h (µSv/h) and/or CPM (CPS). The printed meter scale goes to 0.5 mR/h (5µSv/h) and 300 CPM (5CPS) respectively.

4.4 USING THE SPEAKER

The speaker switch must be "on" to have the speaker chirp for each event detected by the survey meter. If the speaker volume is too low or non-existant with the speaker switch "on", replace the 9V battery. When not in use, the speaker switch must be "off".

4.5 USING THE HEADSET

To use a headset, the phone connector is attached to the terminal located immediately to the left of the post of the handle. In using the headset, the counting rate is indicated by distinct clicks, the frequency of which is equal to the count rate.

4.6 NORMAL BACKGROUND

Since normal background radiation as recorded on this type of instrument is about 0.01 to 0.02 mR/h (0.1 to 0.2µSv/h), little activity will normally be seen or heard. Under background conditions, only about 20 of these randomly spaced "clicks" per minute will be heard.

4.7 USING THE CARRYING STRAP

The instrument may be hand carried strapped over the shoulder. The strap anchors are arranged in such a way that the meter is visible when carried over either the left or right shoulder. Quick "connect and disconnect" fasteners are provided in case of an emergency.

4.8 BATTERY LIFE

CAUTION: Make certain the instrument and the speaker switch are turned OFF when not in use. The life of the "D" batteries is nominally 100 hours under continuous use; for intermittent use, the life may be extended. The indications that the instrument is ON are: (a) the position of the range switch, (b) clicks in the speaker or headphone.

4.9 STORAGE

The instruments are shipped in a packing container and should be left this way until ready to be put into operation. This prevents the accumulation of dirt, moisture, and radioactive contamination, which would interfere with proper operation of the instruments. For storage purposes it is best, whenever possible, to keep the instrument in a moderately cool area, as this will provide greater shelf life for the batteries. If the instrument is to be stored for an extended length of time, remove the batteries.

4.10 DECONTAMINATION

Because this equipment may be used in areas where radioactive contamination is possible, it is recommended that the instrument, probe and accessories be cleaned (after exposure to such conditions) in an accepted manner to avoid both spurious counting or residual radioactive contamination problems.

4.11 BATTERY INSPECTION

Even under continuous use with leakproof cells, it is advisable to check the batteries for leakage at least once per month.

5. CALIBRATION

Operational check of the equipment can be performed by switching to the x1 range and observing the background radiation (normally 0.01-0.02mR/h), (0.1μSv/h-0.2μSv/h). If the speaker is turned "on" or the headphone is used, occasional clicking will be heard.

CAUTION: HIGH VOLTAGE EXPOSED. DO NOT TOUCH BARE WIRES.

5.1 MODEL 3700A CALIBRATION

Many instruments because of their application are required by federal regulations to be calibrated at specific intervals. In the absence of regulations, it is suggested that all survey instruments, including this survey meter be calibrated semi-annually.

1. With the rotary switch in the "off" position, press the BATT CHK pushbutton and verify that the "D" batteries indicate in the "batt" range on the panel meter. If not, replace the "D" batteries.

2. Clip the (-) lead of a 1000 V electrostatic voltmeter to the (-) battery terminal and the (+) lead to the cathode of D101 (see Figure 1). Adjust the HV control (R102) to obtain a 920V reading.

   IMPORTANT: Use only a electrostatic voltmeter to check and adjust high voltage. The use of a digital voltmeter or multimeter will produce erroneous high voltage readings, which could lead to improper adjustments of the high voltage.

3. Rotate the rotary switch to the "X100" position and place the survey meter in the appropriate radiation field (refer to Table 1).

4. If necessary, adjust the X100 control (R112) for the proper indication on the panel meter.

5. Place the survey meter in a field as shown in 2nd value. The meter must indicate within 20% of the actual value.

6. Rotate the rotary switch to the "X10" range and repeat steps 3 through 5 using the values and control listed in Table 1.

7. Rotate the rotary switch to the X1 range and repeat steps 3 and 4. One point is sufficient on this range.

TABLE 1 3700A SUGGESTED CALIBRATION VALUES			
RANGE AND CONTROL	FULL SCALE	CALIBRATION VALUE	2ND VALUE
X100 (R112)	50 mR/h (500µSv/h)	40 mR/h (400µSv/h)	10 mR/h (100µSv/h)
X 10 (R114)	5 mR/h (50µSv/h)	4 mR/h (40µSv/h)	1 mR/h (10µSv/h)
X 1 (R116)	0.5 mR/h (5µSv/h)	0.4 mR/h (4µSv/h)	0.1 mR/h (1µSv/h)

Note: Turning a control potentiometer clockwise will decrease the reading.

5.2 MODEL 3007A CALIBRATION

This instrument is calibrated in CPM (CPS). However, it can be calibrated in mR/h (µSv/h) if a specific 3012 probe is used. Follow the 3700A calibration procedure. Should CPM (CPS) recalibration be necessary, follow these instructions: (See Figure 1)

CAUTION: HIGH VOLTAGE EXPOSED. DO NOT TOUCH BARE WIRES.

1. Clip the (-) lead of a 1000V electrostatic voltmeter to the (-) battery terminal and the (+) lead to the cathode of D101 (see Figure 1). Adjust the HV control to obtain a 920V reading.
2. Connect a pulse generator set for a -5V .02 millesecond wide pulse through a coupling capacitor (.01 µf 1000V) to the 3007A BNC Connector center pin. Connect the common of the pulse generator to the "D" cell (+) battery terminal. Adjust the CAL control for 2000 counts per minute (200x10) reading on the meter.
3. With the 3007A in the appropriate range, set the pulse generator to the calibration value listed in Table 2.

TABLE 2 3007A SUGGESTED CALIBRATION VALUES			
RANGE AND CONTROL	FULL SCALE	CALIBRATION VALUE	2ND VALUE
X100 (R112)	30,000 CPM (500CPS)	25,000CPM (400CPS)	5,000 CPM (100CPS)
X 10 (R114)	3,000 CPM (50CPS)	2,500 CPM (40CPS)	500 CPM (10CPS)
X 1 (R116)	300 CPM (5CPS)	250 CPM (4CPS)	50 CPM (1CPS)

Note: Turning a control potentiometer clockwise will decrease the reading.

Recalibration should be accomplished by a recognized laboratory only. For your convenience, this service is available as an option. If you desire to have DCA do the calibration, pack the instrument securelly and ship it to:

Dosimeter Corporation
6106 Interstate Circle
Cincinnati, Ohio 45242

6. OPERATOR'S MAINTENANCE

6.1 REPLACING THE BATTERIES

The battery check only checks the "D" cell batteries. Whenever the batteries check low with the "batt" check, they must be replaced. Remove and discard old batteries and install new ones as described in 4.1.

6.2 REPLACING THE GEIGER TUBE

The chief maintenance required by this instrument is replacing the batteries (see 6.1). The Geiger tube is halogen quenched so that its operating life is unaffected by use and therefore rarely requires replacement. However, if fresh batteries are installed, and the instrument still does not work correctly, it is preferable to check it with a new Geiger tube before making any further attempts at circuit checking. Make sure the instrument is turned off before removing or installing a Geiger tube.

6.3 CIRCUIT REPAIR

The circuitry consists of a blocking oscillator that generates the high voltage for the GM tube and the low voltage for the measuring unit.

1. Measure the high voltage across C203 with a high input impedance voltmeter. It should be 920 volts DC. If not, adjust R102 for the proper value. If the high voltage cannot be set, check transistor Q300 and transformer T1 with their associated circuitry.

2. Measure the low voltage across D102. It must be 22± 1 volt DC. If not, check D102, C202, and D100 for proper operation.
3. If the survey meter is still not functioning properly, check transistors Q301, Q302,and Q303 with their associated circuitry for proper operation. The pulse rate is a function of the input from a pulse generator or GM tube with test source.

4. If the survey meter is measuring radiation properly but the speaker is not functioning check Q304, U101, the speaker, and the 9V battery.

7.0 WARRANTIES

7.1 INSTRUMENT WARRANTY

Products manufactured by Dosimeter Corporation (DCA)are hereby warrented tobefree fromdefects materials and workmentship for period of one (1) year from the date of delivery to DCA's customer. This warranty is contingent on DCA being advised of any defects within this one year periodAll defective products must be returned with all shipping charges prepaid only AFTER authorization by DCA. A detailed written explanation of the observed defects must accompany each unit. Returned products are subject to inspection by DCA, and DCA reserves the right to make the final decision as to responsibility. THE LIABILITY OF DCA UNDER THIS WARRANTY IS LIMITED TO FREE REPAIR OR REPLACEMENT OF THE DEFECTIVE PRODUCT, OR DEFECTIVE COMPONENT PARTS THEREOF, AT THE SOLE OPTION OF DCA, AND DOES NOT EXTEND TO ANY CONSEQUENTIAL DAMAGES OR OTHER DAMAGES OF ANY TYPE WHATSOEVER. DCA MAKES NO WARRANTIES OF FITNESS FOR PURPOSE OR MERCHANTABILITY AND NO OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, REGARDING THE PURCHASE AND USE OF ITS PRODUCTS AND HEREBY DENIES AND DISCLAIMS ALL LIABILITY BEYOND THE LIABILITY EXPRESSED HEREIN.

7.2 DETECTOR WARRANTY

DCA warrants each tube to be free from defects in material and workmanship when used in these instruments, and no other warranty may be implied. This warranty is effective for six (6) months after the delivery to the original purchaser. If failure has been caused by misuse, alteration, faulty installation, or abnormal conditions of operation, the warranty is void.

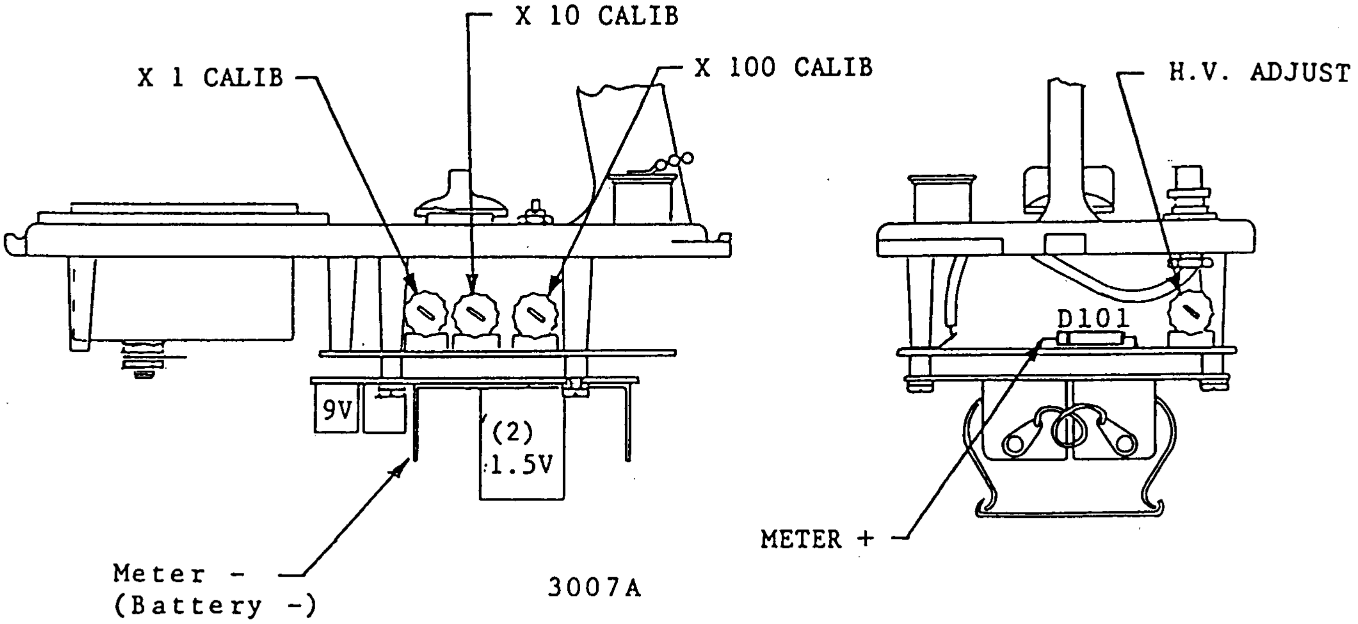
8.0 SPARE PARTS LIST: The following is a list of recommended spare parts:

Ckt. No.	DCA Component Item No.	Description	Quantity
	55-700591-2	Case Assy, Painted Blk	1
	50-700474	Headset Connector Assy	1
	50-700408	Probe Holder Assembly	1
	701203-1	Battery Bracket Assembly	1
	56-700048-2	Handle, Painted Blk	1
	61-150000	Knob	1
	65-300416	Spacer, Phenolic	4
	68-190431	Screw, Pn Hd 2-56 x 1/4	4
	68-270441	Screw, Flt 4-40 x 1/4	2
	67-6323104-08	Screw, Rd Hd 6-32 x 1/2 Blk	3
	67-6323102-12	Screw, Rd Hd 6-32 x 3/4	4
	68-550861	Screw, Hex Hd 10-32 x 1/2	1
	69-005135-1	Washer, Shoulder	4
	69-005138-3	Washer, Lock-Internal 3/8	1
	69-303100	Washer, Lock #6 External	4
	69-503100	Washer, Lock #10 External	1
	75-005498-1	Meter, 0-50 mA.	1
	52-701217-1	DIAL, Meter, Sv	1
	80-310030	Connector, BNC UG-290/U	1
	82-130800	Insulator Tube (Sleeve)	.040 ft.
	56-700054	Strap Assembly, Survey Meter	1
	29-005148-2	Foot, Self Adhesive	4
	62-005477-1	Retainer, Battery	1
	32-005136-14	Lug, Solder	2
	76-005508-1	Switch, Rocker	1
(3700A) only)	59-SK1120	Nut, Gland	
(3700A only)	59-SK1131	Washer, Gland	1
(3700A only)	66-006700	O Ring, 1/4" OD X 1/8 ID	1
(3700A only)	701200-1	Panel, Painted-3700A	1
(3007A only)	701198-1	Panel,Painted-3707	1
(3007A only)	701151-1	BNC Cable Assy	1
	701202-3	P.C. Board Assy.	1
R120	99-415001	Resistor, Carbon 150K 1/4W 5%	1
	701202-1	P.C. Board Sub Assy	
	50-700473	Pushbutton Switch Assembly	1
S3	76-461010	Switch, Pushbutton	1
	67-4403102-04	Screw, Pan HD 4-40 X 1/4	2
	69-270858	Washer, Lock #4	2
	69-276400	Nut, Hex 4-40	2
	69-304800	Lug, Terminal #6 Locking	1
S 1	76-005510-1	Switch, Rotary	
	77-701196-1	P.C. Board Survey	1
A 1	83-005509-1	Speaker, Piezo	1
U101	85-453801	I.C., Dual Multivibrator	1
Q300,303	86-MPS404A	Transistor, MPS404A	2
Q304	86-2N4401-NS	Transistor, 2N4401	1
Q301,302	86-412603	Transistor, Silicon PNP 2N4126	2
D102	87-096901	Diode, Zener IN969B 22V	1
D101	87-250200	Diode, Silicon H.V.	1

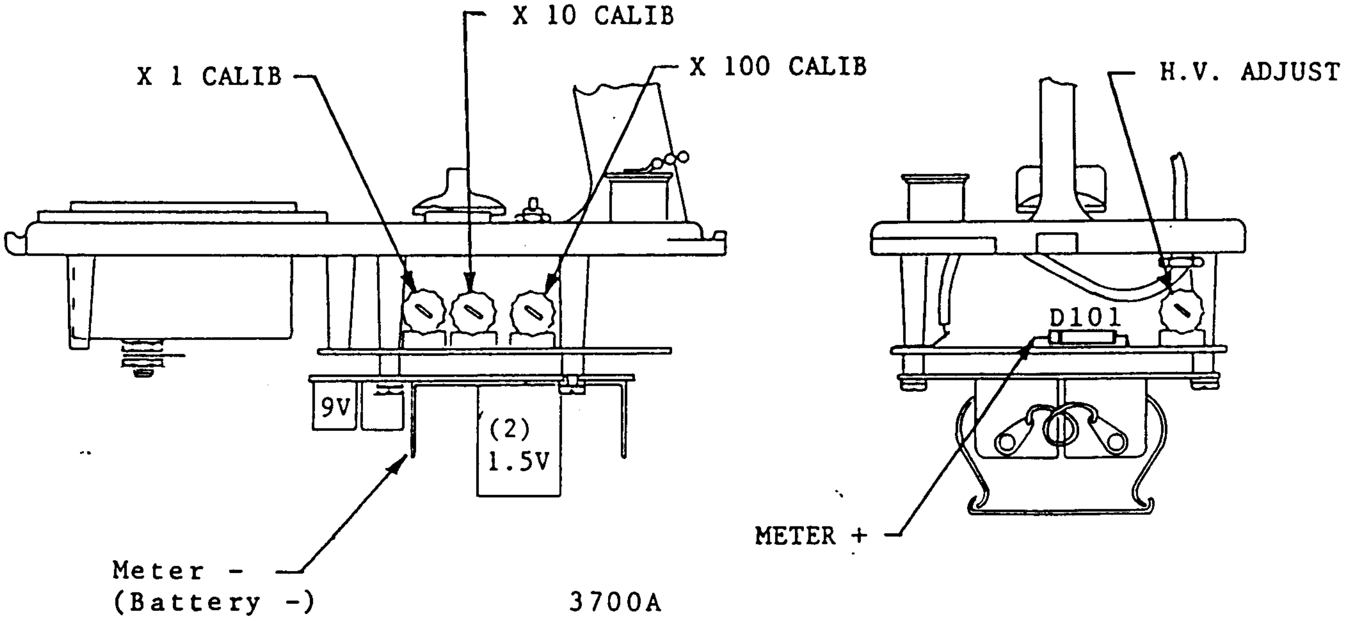
D101	87-250200	Diode, Silicon H.V.	1
D100,103,106	87-400100	Diode, Silicon 1N4001	5
T1	96-805000	Transformer, M8050	1
C204,205	97-122203	Capacitor, Cer. 220PF 1KV	2
C207	97-220401	Capacitor, Poly. .002UF 50V	1
C201	97-310101	Capacitor, Mylar .01UF 50V+-10%	1
C203	97-310201	Capacitor, Cer. .01UF 1. 6KV	1
C206	97-320401	Capacitor, Poly..02 UF	1
C208	97-350101	Capacitor, Mylar .05UF 50V 10%	1
C210	97-410205	Capacitor, Cer. .1UF 100V 10%	1
C200	97-533508	Cap., Tant 3.3 UF 25V 10%	1
C202	97-633301	Capacitor, Electro 33UF 25V	1
C 209	97-722302	Capacitor, Electro 220UF 35V	1
R116	98-005298-10	Potentiometer, 5K	1
R102	98-510001	Potentiometer,1M	1
R112,114	98-005298-9	Potentiometer, 50K	2
R101	99-110001	Resistor, Carbon 100 1/4W 5%	1
R100	99-182001	Resistor, Carbon 820 1/4W 5%	1
R21	99-215001	Resistor, Carbon 1.5K 1/4W 5%	1
R117	99-282001	Resistor, Carbon 8.2K 1/4W 5%	1
R110,111,113	99-310001	Resistor, Carbon 10K 1/4W 5%	3
R109	99-327001	Resistor, Carbon 27K 1/4W 5%	1
R125	99-333001	Resistor, Carbon 33K 1/4W 5%	1
R121,122	99-339001	Resistor, Carbon 39K 1/4W 5%	2
R106	99-347001	Resistor, Carbon 47K 1/4W 5%	1
R118	99-368001	Resistor, Carbon 68K 1/4W 5%	1
R123,124	99-410001	Resistor, Carbon 100K 1/4W 5%	2
R108	99-422001	Resistor, Carbon 220K 1/4W 5%	1
R107	99-522001	Resistor, Carbon 2.2M 1/4W 5%	1
R105	99-610001	Resistor, Carbon 10M 1/4W 5%	1
R103,104	99-680018	Resistor, Metal 80M 1/2W 5%	2
R115	99-147001	Resistor, Carbon 470 1/4W 5%	1
(3700A only)	50-700037	3073 Probe Final Assembly	1
(3700A only)	1-5114-900	GM Tube 5114 @900V	1
(3700A only)	50-700608	Probe Base Assembly	1
(3700A only)	50-700607	Probe Socket Assy.	1
(3700A only)	53-SK1138	Probe Bushing	1
(3700A only)	69-700050	Washer, Probe	1
(3700A only)	80-913000	Connector, 3 Pin Socket	1
(3700A only)	82-841100	Cable, Belden #8411	3.160 ft.
(3700A only)	53-SK1134	Probe Base, SK1-134	1
(3700A only)	68-270271	Screw, Set #4-40 X 1/8	1
(3700A only)	53-SK1135	Probe Sleeve, Outer	1
(3700A only)	53-SK1152	Probe Detent Spring	1
(3700A only)	53-SK1166	Probe Retaining Spring	1
(3700A only)	53-101431	Probe Inner Sleeve Assembly	1
(3700A only)	53-SK1137	Probe Cap	1
(3700A only)	53-SK1157	Probe Sleeve, Inner	1

For each type of probe used, a spare GM tube is recommended:

Model	Probe Model
1-6201T 900	3011 Probe
1-5114 900	3012 Probe
1-8001T 900	3053, 3054, 3055 or 3056



3007A



3700A

Fig. 1 CALIBRATION ADJUSTMENTS

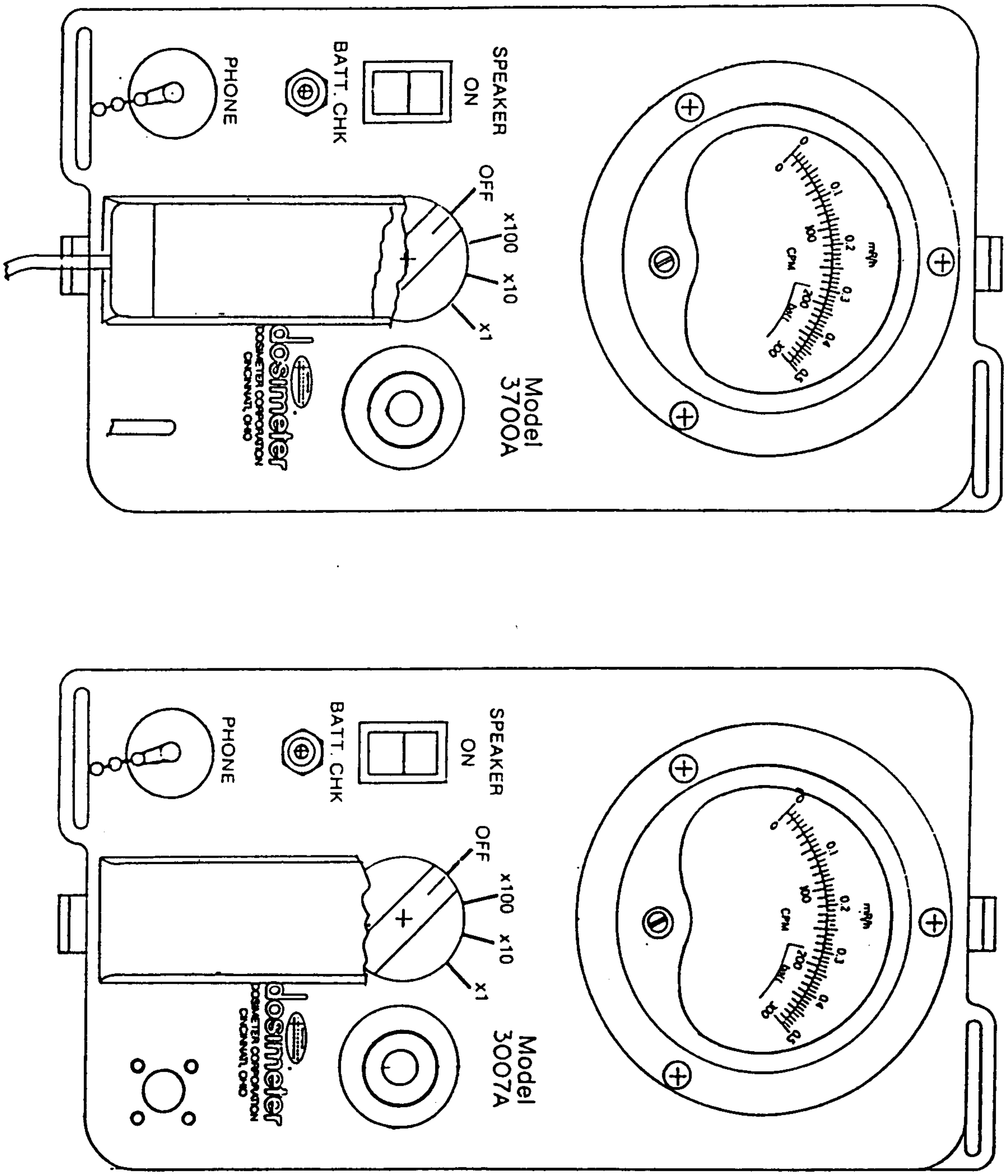


Fig. 2 FRONT PANELS

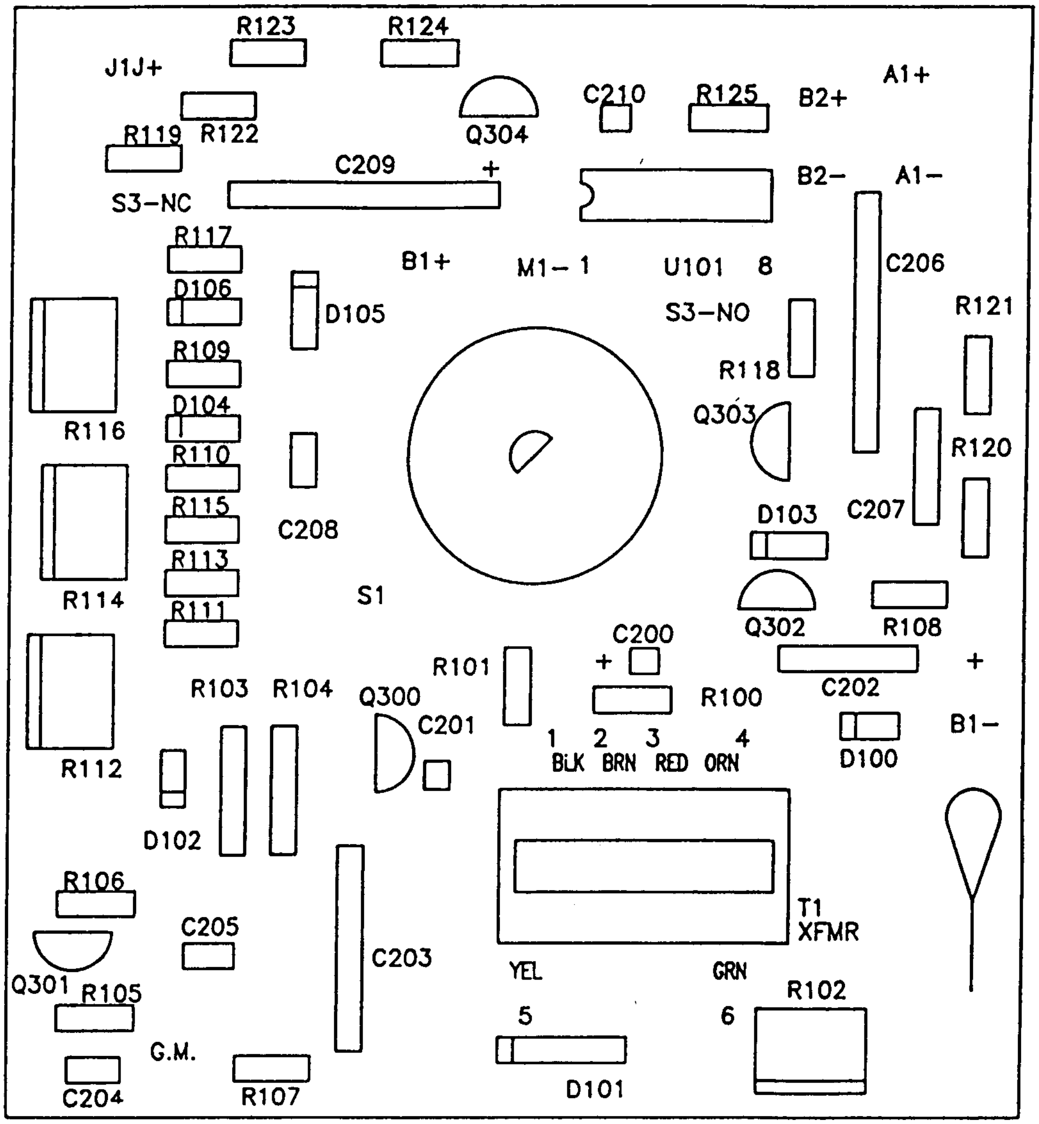


Fig. 3

CIRCUIT BOARD LAYOUT

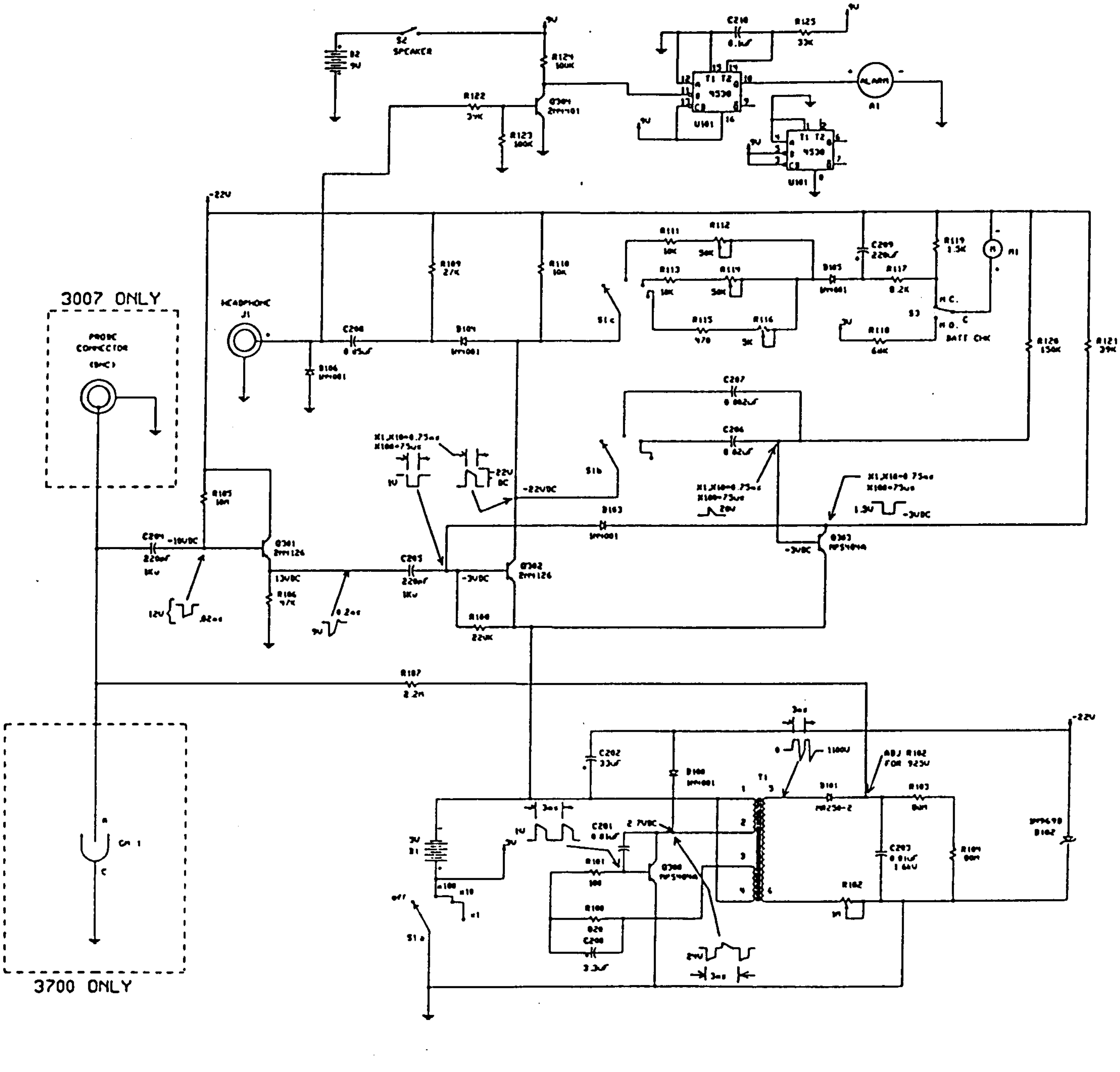


Fig. 4 SCHEMATIC
MODELS 3007A & 3700A